Sawyer Beach, Rye

BEACH WATER QUALITY REPORT
SUMMER 2006

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

BACKGROUND

The New Hampshire Department of Environmental Services (DES) has operated a Public Beach Inspection Program, or Beach Program, for over 20 years. An established coastal beach monitoring program began in 1989 and the program continues to provide monitoring on a weekly basis. DES recognizes the health threat at public beaches. As a result, increased beach monitoring and bacteria source tracking have been implemented to further protect public health.

Coastal beaches are monitored for the presence of the fecal bacteria Enterococci. These fecal bacteria are present in the intestines of warm-blooded animals including humans. Fecal bacteria, when present in high concentrations and ingested, can commonly cause gastrointestinal illnesses such as nausea, vomiting and diarrhea. They are also known as indicator organisms, meaning their presence in water may indicate the presence of other potentially pathogenic organisms.

In October of 2000, the United States Environmental Protection Agency (EPA) signed into law the Beaches Environmental Assessment and Coastal Health (BEACH) Act. The BEACH Act is an amendment to the Clean Water Act, which authorizes the EPA to award grants to eligible states. The purpose of the BEACH Act is to reduce the risk of disease to users of the nation's recreational waters. BEACH Act grants provide support for development and implementation of monitoring and notification programs that help protect the public from exposure to pathogenic microorganisms in coastal recreation waters.

DES received grant funding in 2002 to develop and implement a beach monitoring and notification program consistent with EPA's performance criteria requirements published in the *National Beach Guidance and Required Performance Criteria for Grants* document (www.epa.gov/waterscience/beaches/grants). DES has successfully met all requirements and continues to expand the monitoring and notification program. In 2002, only nine coastal beaches were monitored, while in 2003 and 2004, 15 and 16 beaches respectively, were monitored on a routine basis. Fifteen beaches were sampled again in 2005 and 2006. In 2004, volunteers sampled Star Island beach, but circumstances did not allow for this cooperative effort in 2005 and 2006.

Table of Contents

List of Figures

List of Tables

List of Appendices

Beach Description

Sawyer Beach is owned and maintained by the Town of Rye, New Hampshire. Sawyer Beach is comprised of a soft sand/rocky substrate and has a total length of 1,261 feet. The beach is frequently used by residents for swimming and surfing. There are three access paths to the beach area from the roadside parking area on Route 1. There are lifeguards present throughout the summer and toilet facilities are not available.

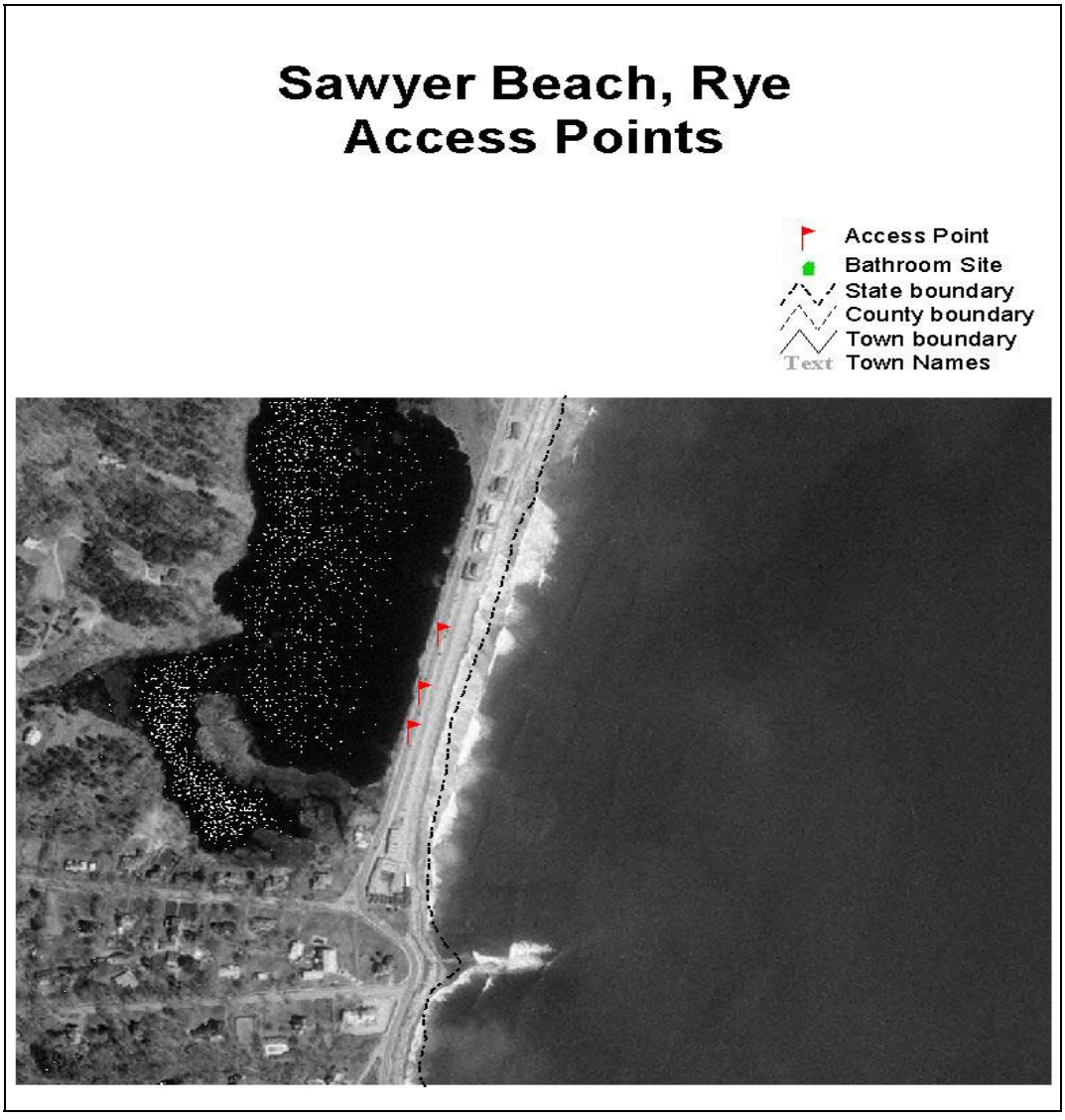

Figure 1. Sawyer Beach Access Points

A large number of waterfowl are frequently observed at the beach. Gulls are typically observed along the Ell Pond discharge where hundreds congregate on a daily basis. Dogs were observed on both June 12 and June 21.

Below is a brief description of the sampling stations at Sawyer Beach, Rye. The stations are pictured in Figure 2.

Table 1. Station Descriptions

Descriptions	Latitude	Longitude
Right sample station: located straight in front of the southern ramp entrance to the beach	42˚ 58' 46.404"	-70˚ 45' 52.5234"
Center sample station: located straight in front of the main beach entrance and lifeguard tower	42˚ 58' 49.1665"	-70˚ 45' 51.3064"
Left sample station: located straight in front of the northern ramp entrance to the beach, not far from Eel Pond Outlet	42˚ 58' 51.7557"	-70˚ 45' 50.286"
Eel Pond Outlet station: where the culvert discharges to the beach area	42˚ 58' 41.86"	-70˚ 45' 53.79"

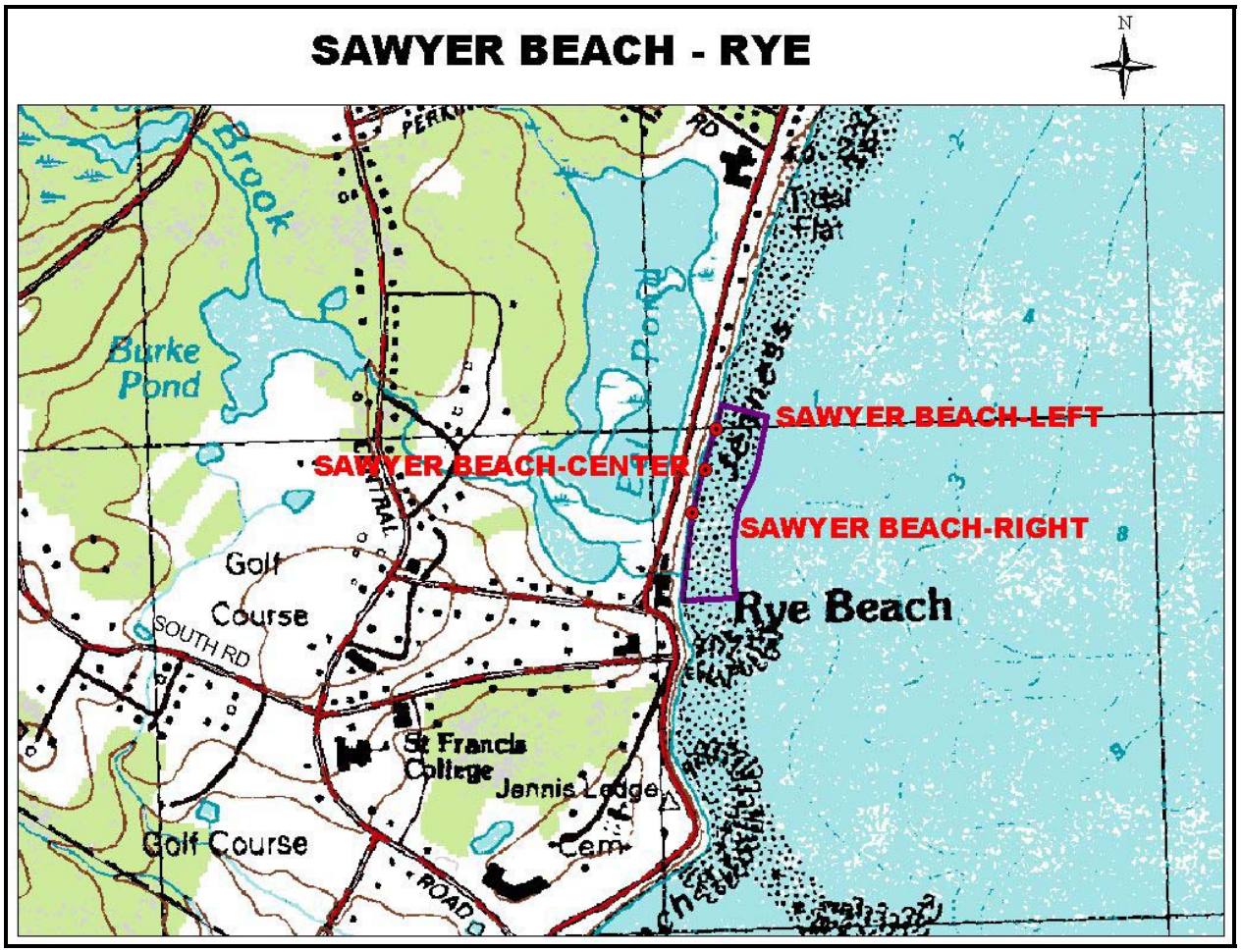

Figure 2. Map of Sawyer Beach

Tier Status and Sampling Frequency

The Beach Program developed a risk-based beach evaluation process and tiered monitoring approach and implemented this approach during the 2003 beach season. Beach evaluations are conducted annually to determine potential health threats to the public. Evaluations are based on several criteria in three main categories: beach history, microbial pathogen sources, and beach use. The evaluations for the 2006 season included a new criterion to assess beaches. Beaches are now assessed as impaired for bacteria. Impairments are based the most recent version of the Consolidated Assessment and Listing Methodology (CALM) submitted to EPA by DES every two years. The CALM assesses beach units as impaired based on historical exceedances of both the single sample and geometric mean bacteria standards.

Based on these criteria, beaches were assigned a Tier I-Impaired, Tier I or Tier II status in 2006. Tier I-Impaired beaches are high priority and have an increased potential to affect public health, Tier I are medium priority, while Tier II are low priority beaches that have less potential to affect public health. Beach sample frequency is based on the Tier statuses; Tier I-Impaired beaches

were sampled twice per week, Tier I beaches were sampled once per week, and Tier II beaches were samples once every other week in 2006.

Sawyer Beach is a Tier I-Impaired beach. It was categorized as a Tier I-Impaired beach due to historical exceedances of the state standard for Enterococci and the issuance of a beach advisory in 2003. This ranking indicates that there are potential pollution sources present that could pose health risks to bathers. The beach ranking has changed since the system was implemented in 2002 Sawyer Beach is sampled twice per week.

Water Quality

Beaches are monitored to ensure compliance with State Water Quality Standards. Marine waters are analyzed for the presence of the fecal bacteria Enterococci. Enterococci are known as indicator organisms, meaning their presence may indicate the presence of other pathogenic organisms. The state standard for Enterococci at public beaches is 104 counts/100 mL in one sample, or a geometric mean of 35 counts/100 mL in three samples collected over 60 days. Standard exceedances require the issuance and posting of a beach advisory. Beach advisories remain in effect until subsequent beach sampling indicates safe water quality conditions.

The number of samples collected at each beach is a function of beach length. Beaches less than 100 feet in length are sampled at left and right locations 1/3 of the distance from either end of the beach. Beaches greater than 100 feet in length are bracketed into thirds and sampled at left, center and right locations. Routine sample collection may be enhanced by sampling known or suspected pollution sources to the beach area. Storm event sampling may be conducted at beaches where wet-weather events are expected to affect beach water quality.

The 2006 season's weather can best be described as unpredictable. The sampling season began on May 30. During the month of May, New Hampshire experienced flood conditions typical of a 100-year flood, while the months of June and July were wetter and warmer than normal, and August was unseasonably cool and dry. May had over 17 inches of rain setting a record high for the month, and over eight inches of rain fell during June (as recorded at Pease International Tradeport, Portsmouth, N.H.). Precipitation was recorded on 34 days of the 95 day sampling season. Twenty-two beach days (beach hours 9:00a.m. to 5:00p.m.) were directly affected by precipitation. In 2006, there were a total of 28 routine inspections with 84 samples collected that included the collection of 19 samples from the Eel Pond outlet.

Table 2 and Figure 3 include the Enterococci data from each sampling event in 2006. Eel Pond outlet was routinely monitored along with the left, center and right beach stations. Overall, Enterococci levels were moderate for the 2006 season. Enterococci levels were elevated on June 15 but no advisory was issued because the official beach season had not begun. Subsequent samples showed a marked decrease in Enterococci. A beach advisory was issued on July 14 after samples collected on July 13 were above the state standards for designated beaches. The Eel Pond Outlet also had elevated Enterococci levels. Over 1.5" of rainfall occurred prior to sampling on June 13. This one event likely washed bacteria laden stormwater into the beach area from Eel Pond. The congregations of gulls along the Eel Pond Outlet also contributed to the elevated bacteria levels. The gulls defecate in the discharge as well as the beach, and their feces

are then transported to beach waters. It was also noted in the August 24 inspection data that beavers had created a dam blocking the Eel Pond culvert. The dam was being removed and this likely contributed to the elevated Enterococci levels at the left station on the same day.

Table 2. Sawyer Beach Enterococci Data 2006

Sample Date	Station Name	Enterococci Results (counts per 100 mL)
5/31/2006	Left	10
	Center	10
	Right	10
6/6/2006	Left	10
	Center	20
	Right	20
6/12/2006	Left	5
	Center	10
	Right	10
6/15/2006	Left	150
	Center	120
	Right	100
6/19/2006	Left	10
	Center	10
	Right	10
6/21/2006	Left	10
	Center	10
	Right	70
6/22/2006	Left	10
	Center	10
	Right	10
6/27/2006	Left	10
	Center	10
	Right	5
6/29/2006	Left	10
	Center	10
	Right	10
7/5/2006	Left	30
	Center	10
	Right	5
7/10/2006	Left	10
	Center	10
	Right	5
7/13/2006	Left	170
	Center	110
	Right	100
7/17/2006	Left	10
	Center	10
	Right	10

7/18/2006	Left	5
	Center	10
	Right	10
7/19/2006	Left	10
	Center	10
	Right	10
7/24/2006	Left	10
	Center	5
	Right	10
7/25/2006	Left	10
	Center	10
	Right	10
8/2/2006	Left	10
	Center	10
	Right	10
8/3/2006	Left	20
	Center	10
	Right	30
8/8/2006	Left	10
	Center	10
	Right	10
8/9/2006	Left	10
	Center	20
	Right	10
8/14/2006	Left	10
	Center	10
	Right	10
8/15/2006	Left	10
	Center	10
	Right	10
8/23/2006	Left	20
	Center	10
	Right	10
8/24/2006	Left	100
	Center	10
	Right	20
8/28/2006	Left	10
	Center	10
	Right	10
8/30/2006	Left	10
	Center	10
	Right	10

Figure 3 depicts the relationship between Enterococci data at Sawyer Beach and the state standard for coastal beaches.

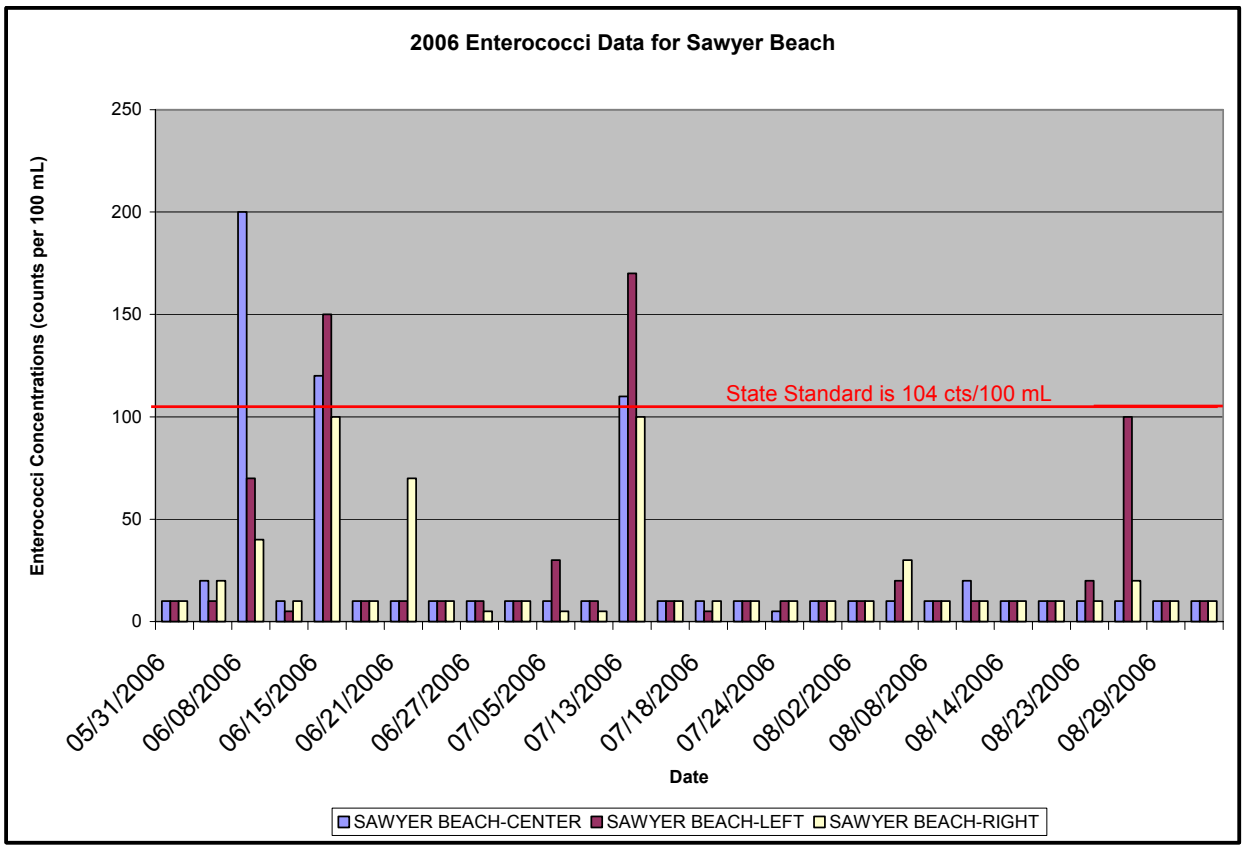

Figure 3. Sawyer Beach Enterococci Data 2006

Table 3 and Figure 4 depict Enterococci data collected from the Eel Pond Outlet. This was the third season Eel Pond was routinely monitored. Enterococci levels were elevated on two occasions this season. Beach program personnel believe that the elevated level on July 13 was a result of to heavy rainfall on July 12. On August 15 rainfall totaling 0.30 inches occurred, once again contributing to elevated Enterococci levels. Eel Pond supports a healthy population of ducks, geese, swans, and beavers. The waterfowl tend to congregate at a roadside clearing adjacent to the Eel Pond outlet. Gulls, often numbering in the hundreds, are also frequently observed on the beach surrounding the discharge from Eel Pond. Waterfowl feces contain bacteria that contaminate the surrounding waters and elevate Enterococci levels.

Table 3. Eel Pond Outlet Enterococci Data 2006

Sample Date	Enterococci Results (counts per 100 mL)
5/31/2006	10
6/6/2006	10
6/15/2006	10
6/19/2006	10
6/21/2006	20
6/27/2006	10
6/29/2006	30
7/5/2006	10
7/13/2006	400
7/17/2006	30
7/18/2006	30
7/19/2006	50
8/2/2006	20
8/3/2006	40
8/14/2006	50
8/15/2006	450
8/23/2006	30
8/29/2006	40
8/30/2006	50

Figure 4 depicts the Eel Pond Outlet 2006 Enterococci data.

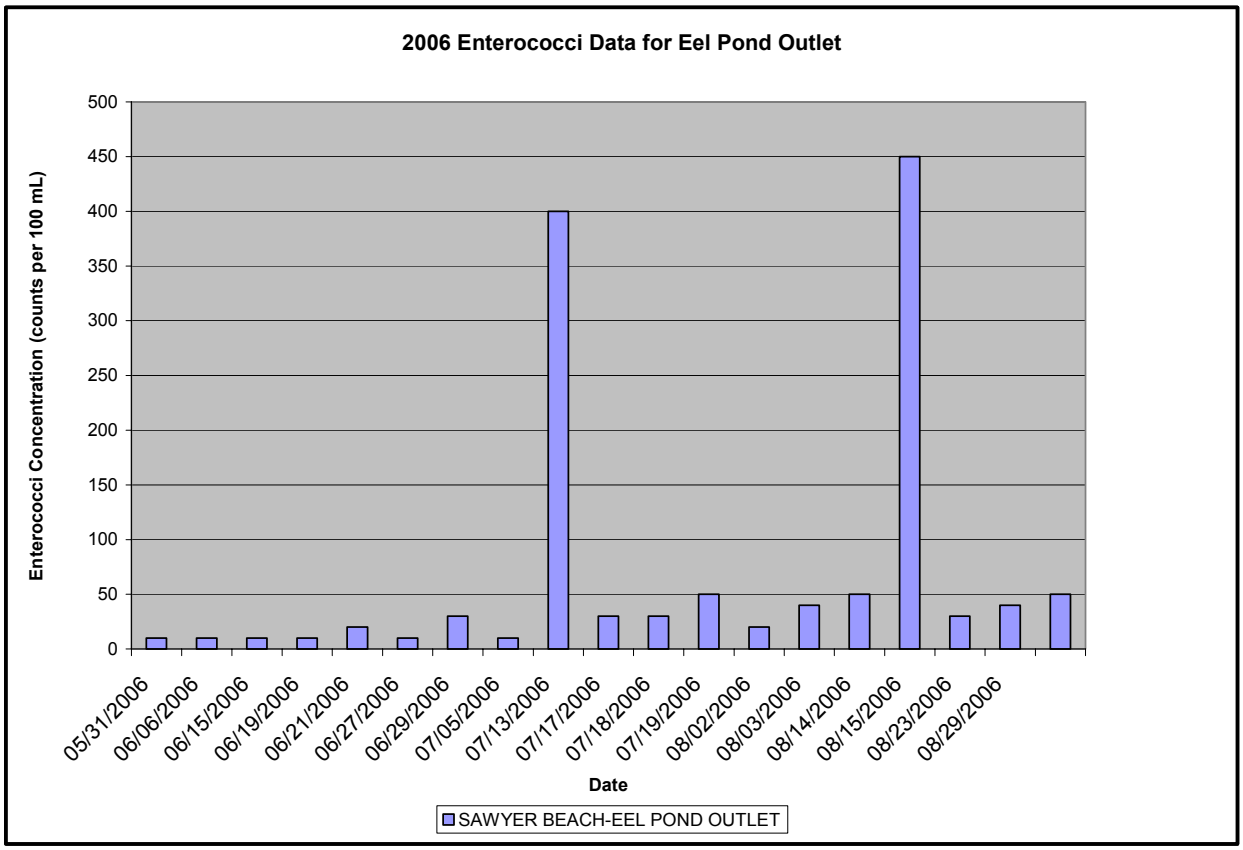

Figure 4. Eel Pond Outlet Enterococci Data 2006

Areas of Concern

As mentioned previously, seagulls are observed congregating along the Eel Pond Discharge at the Sawyer Beach left station. Inspectors noted between 50 and 200 waterfowl near the left sampling station along the Eel Pond discharge. There were numerous occasions when inspectors noted the beach was covered by waterfowl feces. Some waterfowl are capable of defecating up to 28 times per day. Fecal material contains millions of bacteria that are potentially harmful to public health. The Eel Pond discharge flows over feces and transports bacteria to beach waters. Feces observed on the beach during high tide contribute to beach bacteria levels.

Town officials have expressed concern regarding children playing in the Eel Pond discharge. As mentioned above, bacteria levels were elevated on numerous occasions, posing a potential public health risk. Children are more susceptible to contracting water-borne illnesses. A proactive approach to protecting children is to issue an advisory for the Eel Pond discharge to deter children from engaging in recreational activities. The area should be roped off to the public.

Recent studies in California and the Great Lakes have measured elevated bacteria in beach sand. Due to the number of waterfowl and the Eel Pond discharge, a study to document the bacteria

presence and amounts in the sand at Sawyer Beach will be conducted during the summer of 2007. Sawyer Beach will be one of four beaches involved in the study.

Thoughts for the Future

- The town of Rye, local businesses, or school group should join DES's Adopt-a-Beach Program. The program would consist of beach clean-ups and water quality monitoring. DES would conduct training sessions and participate in education and outreach activities for the community. If you are interested, please contact Alicia Carlson at (603) 271-0698 or acarlson@des.state.nh.us.

- The town should implement waterfowl management strategies at Eel Pond and Sawyer Beach.

- The town should restrict public access to the Eel Pond discharge area. The area immediately in front of the drainage system should be roped off to discourage children from recreating in the water. Also, signs should be posted to indicate the area may be unsafe for water contact due to elevated bacteria levels. Lifeguards should also patrol the area and discourage such activities.

Appendix A

Special Topic 2006

Rapid Assessment Methodology for the Detection of Microbiological Indicators

To assess beach water quality, the Department of Environmental Services (DES) monitors fecal indicator bacteria levels at coastal beaches on a routine basis. Unfortunately, results from sample analysis can take anywhere from 24 to 48 hours. Because it takes at least 24 hours to receive results, beach managers and the public are not informed of water quality problems until after the public may have been exposed. This is an issue facing beach officials throughout the world, and is a priority of the US Environmental Protection Agency (EPA). The EPA, universities and private entities are researching rapid assessment methods to enumerate bacteria and viruses. These methods will allow beach officials to post advisories on the same day water quality is impaired, thus, better protecting public health. There are three different rapid assessment method technologies available: Molecular surface recognition, nucleic acid detection and enzyme/substrate based methods. All rapid assessment methods will take less than two hours to obtain results.

Molecular surface recognition methods capture and/or label the target bacterium by binding to molecular structures on the exterior surface or in its genetic material. Analyses of coastal beach water samples currently employ culture-based methods for the detection of Enterococci bacteria, an indicator for fecal pollution in marine water. The quickest culture-based method takes up to 24 hours to provide results. Now, a new method is being developed to enumerate Enterococci. This new method uses Transcription-Mediated Amplification (TMA) with a fluorescently-labeled probe to amplify a specific region of Enterococci ribosomal RNA (rRNA).

The TMA rapid assessment method is currently being tested in Southern California. Method development is moving quickly and will likely come to execution within five years. Method cost is a significant reason the new technology is not currently being employed. Once this procedure is widely and routinely accepted, the expenses should lower. This rapid assessment method is very beneficial as it will allow beach managers to take immediate action towards protecting the public from waterborne pathogen exposure on the same day water is sampled.

Another rapid assessment method being developed for fecal indicator detection is Quantitative Polymerase Chain Reaction (QPCR). QPCR is a nucleic acid detection method that targets genetic material of bacteria, viruses or protozoan indicators. QPCR is used to test for both *E. coli* and Enterococci. Results can be obtained from this method on an average of two hours after sampling. This method has demonstrated 85-90 percent agreement with existing routine methods. QPCR can be used to detect other water quality indicators such as *Bacteroides thetaiotamicron* and human enterovirus. Studies indicate that ratios of *B. thetaiotamicron* may provide useful information as to fecal contamination sources.

The final rapid assessment technology methods available are the enzyme/substrate based methods. These methods pair chromogenic or fluorogenic substrate methods already widely used with advanced optical or electrical detectors. These methods are directed at reducing the incubation periods of current membrane filtration methods. Some of these methods measure excitation and absorbance of the fluorescent metabolite of Enterococci using a fluorometer to speed the detection rate. A popular type of enzyme/substrate method is called the Dual-Wavelength Fluorimetry (DWF).

These rapid assessments methods are currently being tested for accuracy, sensitivity and efficiency. Research indicates that these new methods will be made available within the next five years. Once these technologies are made available and laboratories adopt the methods, beach management will have a new tool to better protect public health. With assistance from EPA Beach Grants, New Hampshire will be proactive in employing accepted methods.